

AMENDMENTS TO THE SPECIFICATION

Please replace the paragraph beginning on page 1, between lines 3 and 4, with the following rewritten paragraph:

This is a divisional application of Serial No. 10/335,885, filed January 3, 2003, which is a divisional application of Serial No. 09/932,983, filed August 21, 2001, which is a divisional application of Serial No. 09/195,998, filed November 20, 1998, now U.S. Patent No. 6,393,574, which is a divisional application of Serial No. 08/721,736, filed September 27, 1996, now U.S. Patent No. 5,923,869.

Please replace the paragraph beginning at page 1, line 6, with the following rewritten paragraph:

The present invention relates to a method and apparatus for seamlessly reproducing a bitstream having non-sequential system clock data therein and, more specifically, to a bitstream for use in an authoring system for variously processing a data bitstream comprising the video data, audio data, and sub-picture data constituting each of plural program titles containing related video data, audio data, and sub-picture data content to generate a bitstream from which a new title containing the content desired by the user can be reproduced, and efficiently recording and reproducing ~~said~~ the generated bitstream using a particular recording medium.

Please replace the paragraph beginning at page 2, line 15, with the following rewritten paragraph:

It is therefore necessary to develop and prove a bitstream structure and an advanced digital processing method including both recording and reproduction capabilities whereby a large volume, multiple level hierarchical digital bitstream can be efficiently controlled at each level of the hierarchy. Also needed are an apparatus for executing this digital processing method, and a recording media to which the bitstream digitally processed by ~~said~~ the apparatus can be efficiently recorded for storage and from which ~~said~~ the recorded information can be quickly reproduced.

Please replace the paragraph beginning at page 2, line 26, with the following rewritten paragraph:

Means ~~of~~ for increasing the storage capacity of conventional optical disks have been widely researched to address the recording medium aspect of this problem. One way to increase the storage capacity of the optical disk is to reduce the spot diameter D of the optical (laser) beam. If the wavelength of the laser beam is λ and the aperture of the objective lens is NA , then the spot diameter D is proportional to λ/NA , and the storage capacity can be efficiently improved by decreasing λ and increasing NA .

Please replace the paragraph beginning at page 5, line 11, with the following rewritten paragraph:

In other words, except when a video object VOB, which is normally a single-stream title editing unit, is divided into discrete streams, seamless reproduction cannot be achieved by simply connecting and reproducing individual ~~VOB~~ VOBs. This is because while the reproduction of video, audio, and sub-picture streams forming each VOB must be synchronized, the means for achieving this synchronization is enclosed in each VOB. As a result, the synchronization means will not function normally at VOB connections if the ~~VOB~~ VOBs are simply connected together.

Please replace the paragraph beginning at page 5, line 25, with the following rewritten paragraph:

The object of the present invention is therefore to provide an optical disk medium from which data can be seamlessly reproduced without audio or video intermitting even in such multi-scene periods, and a reproducing apparatus implementing ~~said~~ the recording and reproducing method.

Please replace the paragraph beginning at page 6, line 7, with the following rewritten paragraph:

The present invention has been developed with a view to substantially solving the above described disadvantages and has for its essential object to provide an improved method and apparatus for reproducing a bitstream having non-sequential system clock data seamlessly therebetween.

Please replace the paragraph beginning at page 6, line 13, with the following rewritten paragraph:

In order to achieve the aforementioned objective, a system stream contiguous reproduction apparatus to which are input one or more system streams interleaving at least moving picture data and audio data, and system stream connection information comprises a system clock STC generator for producing the system ~~clock that~~ clock that is used as the system stream reproduction reference clock, one or more signal processing decoders that operate referenced to the system clock STC, decoder buffers for temporarily storing the system stream data transferred to the corresponding signal processing decoders, and STC selectors for selecting a system clock STC referenced by the signal processing decoders when decoding the first system stream, and another system clock STC referenced by the signal processing decoders when decoding a second system stream reproduced contiguously to the first system stream.

Please replace the paragraph beginning at page 7, line 7, with the following rewritten paragraph:

Fig. 1 is a graph schematically showing a structure of ~~multi-media~~ multimedia bit stream according to the present invention,

Please replace the paragraph beginning at page 8, line 16, with the following rewritten paragraph:

Fig. 16 is a graph schematically showing the structure of a multimedia bit stream for use in Digital Video Disk system according to the present invention,

Please replace the paragraph beginning at page 9, line 1, with the following rewritten paragraph:

Fig. 21 is a graph ~~is in~~ assistance of explaining a concept of parental look playback control according to the present invention,

Please replace the paragraph beginning at page 9, line 19, with the following rewritten paragraph:

Fig. 28 is a graph schematically showing an encoding information ~~tables~~ table,

Please replace the paragraph beginning at page 10, line 8, with the following rewritten paragraph:

Fig. 35 is a flow chart showing ~~detailed~~ details of the encode parameter production subroutine of Fig. 34,

Please replace the paragraph beginning at page 10, line 10, with the following rewritten paragraph:

Fig. 36 is a flow chart showing the ~~detailed~~ details of the VOB data setting routine of Fig. 35,

Please replace the paragraph beginning at page 10, line 18, with the following rewritten paragraph:

Fig. 40 is a graph in assistance of explaining ~~the relationship~~ the relationship between the SCR, APTS, VDTS, and VPTS values,

Please replace the paragraph beginning at page 12, line 10, with the following rewritten paragraph:

Fig. 60 is a flow chart showing an ~~during non-seamless reproduction~~ operation of the STC selection controller of Fig. ~~59~~ 39 during an a non-seamless reproduction operation,

Please replace the paragraph beginning at page 12, line 13, with the following rewritten paragraph:

Fig. 61 is a flow chart showing the operation of the STC selection controller of Fig. 39 during a seamless reproduction operation,

Please replace the paragraph beginning at page 12, line 16, with the following rewritten paragraph:

Fig. 62 is a flow chart showing the data ~~transferring~~ transferring operation of Fig. 57,

Please replace the paragraph beginning at page 12, line 24, with the following rewritten paragraph:

Fig. 66 is a flow chart showing ~~an~~ a modification of Fig. 63,

Please replace the paragraph beginning at page 12, line 28, with the following rewritten paragraph:

Fig. 68 is a flow chart showing details of the non-seamless multi-angle decoding process of Fig. 62,

Please replace the paragraph beginning at page 16, line 7, with the following rewritten paragraph:

The bitstream encoded by the authoring encoder EC of the present embodiment is recorded, by way of example only, to an optical disk.

Please replace the paragraph beginning at page 16, line 10, with the following rewritten paragraph:

The scenario editor 100 of the authoring encoder EC outputs the scenario data, i.e., the user-defined editing instructions. The scenario data controls editing of the corresponding parts of the multimedia bitstream MBS according to the user's manipulation of the video, sub-picture, and audio components of the original multimedia title. This scenario editor 100 preferably comprises a display, speaker(s), keyboard, CPU, and source stream buffer. The scenario editor 100 is connected to an external multimedia bitstream source from which the multimedia source data St1, St3, and St5 are supplied.

Please replace the paragraph beginning at page 29, line 12, with the following rewritten paragraph:

A detail of the authoring system is disclosed in Japanese Patent Application filed September 27, 1996, and entitled and assigned to the same assignee as the present application.

Please replace the paragraph beginning at page 55, line 7, with the following rewritten paragraph:

When plural of these data streams are interleaved, the navigation packs NV defining the relationship between the interleaved packs must also be interleaved at a defined unit known as the pack number unit. Each group_of_pictures GOP is normally a unit containing approximately ~~0.~~
~~5~~ 0.5 sec. of video data, which is equivalent to the presentation time required for 12-15 frames, and one navigation pack NV is generally interleaved with the number of data packets required for this presentation time.

Please replace the paragraph beginning at page 60, line 20, with the following rewritten paragraph:

When two system streams are seamlessly connected but the audio components of the two system streams are not contiguous, particularly immediately before and after the seam, it is necessary

to pause the audio output to synchronize the audio and video components of the system stream following the seam. Note that non-contiguous audio may result from different audio signals being ~~recording~~ recorded with the corresponding video blocks. With an NTSC signal, for example, the video frame cycle is approximately ~~33.33~~ 33.33 msec while the AC-3 audio frame cycle is 32 msec.

Please replace the paragraph beginning at page 65, line 14, with the following rewritten paragraph:

A group_of_pictures GOP in which coding is closed completely within that GOP is known as a ~~"closed GOP."~~ "closed GOP." A group_of_pictures GOP containing a frame coded with reference to a frame in a preceding or following (ISO-13818 DOES NOT LIMIT P- and B-picture CODING to referencing PAST frames) group_of_pictures GOP is an "open GOP." It is therefore possible to playback a closed GOP using only that GOP. Reproducing an open GOP, however, also requires the presence of the referenced GOP, generally the GOP preceding the open GOP.

Please replace the paragraph beginning at page 68, line 22, with the following rewritten paragraph:

The basic configuration of the DVD decoder DCD according to this embodiment is the same as that of the authoring decoder DC shown in Fig. 3. The differences are that a different video decoder 3801 (shown as 3800 in Fig. ~~26~~ 23) is used in place of the video decoder 3800, and a reordering buffer 3300 and selector 3400 are disposed between the video decoder 3801 and synthesizer 3500.

Please replace the paragraph beginning at page 83, line 24, with the following rewritten paragraph:

In other words, by splitting scene-specific data into plural units of a specified data size, and interleaving plural split data units for different scenes in a predefined sequence that is recorded to the disk within the jumping range whereby ~~an~~ a data underflow state does not occur, it is possible

to reproduce the selected scenes without data interruption by intermittently accessing and decoding the data specific to the selected scenes using these split data units. Seamless data reproduction is thereby assured.

Please replace the paragraph beginning at page 84, line 15, with the following rewritten paragraph:

Referring to Fig. 71, VOB-A and VOB-E are video objects with independent playback start and end times, and are in principle arrayed to contiguous block regions. As shown in Fig. 24, the playback start and end times of VOB-B, VOB-C, and VOB-D are aligned during interleaving. The interleaved data blocks are then recorded to the disk to a contiguous interleaved block region. The contiguous block regions and interleaved block regions are then written to disk in the track path Dr direction in the playback sequence. Plural video objects VOB, i.e., interleaved video objects VOBS, arrayed to the data recording track TR are shown in Fig. 37 71.

Please replace the paragraph beginning at page 84, line 27, with the following rewritten paragraph:

Referring to Fig. 37 72, data regions to which data is continuously arrayed are called "blocks," of which there are two types: "contiguous block regions" in which VOB with discrete starting and end points are contiguously arrayed, and "interleaved block regions" in which plural VOB with aligned starting and end points are interleaved. The respective blocks are arrayed as shown in Fig. 38 74 in the playback sequence, i.e., block 1, block 2, block 3, . . . block 7.

Please replace the paragraph beginning at page 85, line 7, with the following rewritten paragraph:

As shown in Fig. 73 72, the VTS title VOBS (VTSTT_VOBS) consist of blocks 1-7, inclusive. Block 1 contains VOB 1 alone. Blocks 2, 3, 5, and 7 similarly discretely contain VOBS 2, 3, 6, and 10. Blocks 2, 3, 5, and 7 are thus contiguous block regions.

Please replace the paragraph beginning at page 85, line 24, with the following rewritten paragraph:

Each cell comprises one or more video object unit VOB with the video object unit VOB defining the boundaries of the cell. Each cell also contains information identifying the position of the cell in the program chain PGC (the playback control information of the digital video disk system). More specifically, this position information is the address of the first and last VOB in the cell. As also shown in Fig. 73, these VOB and the cells defined therein are also recorded to a contiguous block region so that contiguous blocks are contiguously reproduced. Reproducing these contiguous blocks is therefore ~~no~~ not a problem.

Please replace the paragraph beginning at page 87, line 4, with the following rewritten paragraph:

The multi-scene period is described together with the concept of multi-scene control according to the present invention using, by way of example, a title comprising scenes recorded from different angles.

Please replace the paragraph beginning at page 107, line 4, with the following rewritten paragraph:

The encode parameter production steps (step #1800) are described in greater detail below referring to Figs. ~~52~~ 35, ~~53~~ 36, ~~54~~ 37, and ~~55~~ 38.

Please replace the paragraph beginning at page 108, line 25, with the following rewritten paragraph:

The encode parameter production subroutine shown as step #1800 in Fig. 34B is described next using Figs. ~~52, 53, and 54~~ 35, 36, 37, and 38 using by way of example the operation generating the encode parameters for multi-angle control.

Please replace the paragraph beginning at page 114, line 6, with the following rewritten paragraph:

At step ~~#1872~~ #1874 the number of interleaved VOB divisions ILV_DIV is extracted from the scenario data St7.

Please replace the paragraph beginning at page 115, line 25, with the following rewritten paragraph:

At step #2312 it is determined whether multi-scene selection control is enabled based on the multi-scene flag VOB_Fp in the VOB Set data stream. If step #2312 returns NO, i.e., multi-scene control is not enabled, the procedure moves to step ~~#2114~~ #2314.

Please replace the paragraph beginning at page 116, line 5 with the following rewritten paragraph:

If step #2312 returns YES, i.e., multi-scene control is enabled, the procedure moves to step ~~#2116~~ #2316.

Please replace the paragraph beginning at page 125, line 9, with the following rewritten paragraph:

At step #2402 a value "~~00b~~" 00 is written to the cell block mode CBM (Fig. 16) of the cell playback information blocks C_PBI #i containing the VOB control information for each scene based on the multi-angle flag VOB_Fm state, which is set to 0 to indicate that multi-angle control is not enabled in the multi-scene period.

Please replace the paragraph beginning at page 128, line 7, with the following rewritten paragraph:

At step #2430 a value "~~00b~~" 00 indicating a "non-cell block", i.e., that there is only one cell in the functional block, is written to the cell block mode CBM (Fig. 16) of the cell playback information blocks C_PBI #i containing the VOB control information for each scene based on the

multi-scene flag VOB_Fp state, which is set to 0 to indicate that the scene is a single scene and not part of a multi-scene period.

Please replace the paragraph beginning at page 132, line 10, with the following rewritten paragraph:

The cell information register contains the following sub-registers: the cell block mode CBM_reg, cell block type CBT_reg, seamless reproduction flag SPF_reg, interleaved allocation flag IAF_reg, STC resetting flag ~~STCDF~~ STCDF_reg, seamless angle change flag SACF_reg, first cell VOB start address C_FVOBU_SA_reg, and last cell VOB start address C_LVOBU_SA_reg.

Please replace the paragraph beginning at page 133, line 11, with the following rewritten paragraph:

The STC resetting flag ~~STCDF~~ STCDF_reg defines whether the system time clock STC used for synchronization must be reset when the cell is reproduced; when resetting the system time clock STC is necessary, STC_RESET is stored; if resetting is not necessary, STC_NRESET is stored.

Please replace the paragraph beginning at page 139, line 13, with the following rewritten paragraph:

The stream buffer data transfer process of step #31032 is described in further detail below referring to Fig. ~~70~~ 62. The stream buffer data transfer process (step #31032) comprises steps #31040, #31042, #31044, #31046, and #31048 shown in the figure.

Please replace the paragraph beginning at page 139, line 23 with the following rewritten paragraph:

However, if step ~~#30140~~ #31040 returns YES because the cell is a multi-angle cell, the procedure moves to step ~~#30142~~ #31042 where the seamless angle change flag SACF is evaluated to determine whether seamless angle reproduction is specified.

Please replace the paragraph beginning at page 139, line 28 with the following rewritten paragraph:

If seamless angle reproduction is specified, the seamless multi-angle decoding process is executed in step ~~#30146~~ #31046. If seamless angle reproduction is not specified, the non-seamless multi-angle decoding process is executed in step ~~#30148~~ #31048.

Please replace the paragraph beginning at page 144, line 1, with the following rewritten paragraph:

Another method of accomplishing the non-multi-angle cell decoding process (step #31044, Fig. 62) is described below with reference to Fig. ~~64~~ 66.

Please replace the paragraph beginning at page 147, line 1 with the following rewritten paragraph:

The non-seamless multi-angle decoding process executed in step ~~#30148~~ #31048, Fig. 62, is described below referring to Fig. 68.

Please replace the paragraph beginning at page 148, line 23, with the following rewritten paragraph:

It is very important that DVD decoder according to the present invention can promptly ~~moves~~ move to the next data reading process and effectively performs the data reading once after the detection of the end of data such as interleave unit ILVU and video object unit VOBV for the sake of seamless reproduction which is one of the main targets of the present invention.